A coating agent for paper surfaces

The present invention relates to a coating agent for paper surfaces.

Paper surfaces having an excellent smoothness and gloss as well as a reduced permeability may be produced with coating agents.

It is known to coat paper surfaces with coating agents made of polymer dispersions whose disperse phases consist of about 95% polymer particles having a diameter of larger than 0.003 mm. Usually, these dispersions are mixed with pigments or other mineral small-sized fillers or filler mixtures (examples thereof include aerosil, chalk, carbonates, such as calcium carbonate, clay, etc.), and then applied to the paper surface by means of spread coating. The thickness of the finished layer amounts to about 0.01 mm. A surface thus coated is coated with a solution of polymers in organic solvents to obtain a further technical upgrading of papers used for packaging. So far, this subsequent coating with polymers dissolved in organic solvents has been necessary in particular for those paper surfaces which are to be aluminized in vacuum. This technology wherein, prior to vacuum metallizing, solutions of organic polymers are used to apply a polymeric film on the paper surface consumes large amounts of organic solvents, that is about 5.5 g of solvent per m^2 of paper, depending on the solids content of the polymer solution. With the usual operating speed of 300 m/min. and a width of 1.60 m this results in about 2.6 kg of vaporous solvents per minute. Although the solvent can be recovered, this involves comparatively high capital cost with respect to both the required facilities and the running operational expenses therefor. The thermal removal of the solvent vapor is by far more cost-intensive. On the one hand, the high initial investment for removing the solvent is due to the fact that plant and devices

have to be explosion-proof and, on the other hand, that the operating staff must be protected from toxic solvent vapor.

It is also known to coat paper surfaces from an aqueous dispersion with polymer dispersions having a particle size of larger than 0.01 mm and a distribution maximum of about 0.05 mm on the specific distribution curve. However, these coatings are unsuitable for the engraved roll-technology, i.e., they cannot be used for this purpose. Owing to their particle size these coatings have correspondingly coarse surface structures. After the actual drying of the dispersing agent, the paper web must additionally be heated under considerable thermal energy expenditure to form an optimum film; this in turn requires additional energy to cool the paper web prior to rolling it up, in order to prevent the individual layers from sticking together when wound up. For this reason, special coaters had to be developed and constructed for this technology to eliminate the inherent coagulation tendency of the dispersion systems. As compared to applying the polymer coat from the solution in an organic solvent, the film thickness tolerance is also a disadvantage, i.e., the polymer film applied from organic solvents is more uniform and has a more uniform thickness than the polymers applied from aqueous dispersion.

Recently papers have increasingly been finished in an ecologically beneficial manner in order to conserve natural resources and the environment, i.e., products used in finishing or production are reused intelligently by recycling them; however, to achieve a sufficient surface quality it has not been possible so far in the production of vacuum-metallized paper, in particular aluminized paper, to abstain from a coating using large amounts of organic solvents.

It is accordingly the object of the present invention to provide a coating agent, in particular for paper surfaces to be metallized in vacuum, under avoidance of organic solvents. The coating agent

makes it possible to achieve from an aqueous dispersion both a homogeneous coat after elimination of the water and an even layer thickness; moreover, it may be applied by means of engraved rolls or gravure printing. In particular, the use of engraved-rolls-technology is of importance because the coating may be metered precisely. The cups of the engraved rolls or also the print rolls clog up after a short operating time. Even in case of a high degree of dilution with solids contents of about 13%, this pluggage after longer operation periods results in coagulation under the doctor blade.

According to the present invention this object is achieved by a coating agent which comprises dispersed in the aqueous phase a mixture of polymer particles having an average particle size of 0.2 to 5 μ, preferably 0.3 to 2 μ, as well as particles of an average particle size of smaller than 0.1 μm, preferably smaller than 0.07 μm.

The mixing ratio of coarser polymer particles, which may be crosslinked or uncrosslinked, to the finer polymer particles, which are present as a microdispersion or hydrosol, may vary within wide ranges, but preferably amounts to 1 : 1 (50 : 50) to 9 : 1 (9 : 1), preferably is in the range of from 1.5 : 1 (60 : 40) to 3 : 1.

Usually, the aqueous dispersion consisting of polymer particles of larger diameter and of very small-sized polymers with hydrosol properties has dispersing agents for the two polymer components, which advantageously have different surface tensions. Suitable dispersants include, for example, fatty alcohol ethoxylates and/or carboxylic acid salts.

Suitable polymers for both the coarser portion and the small-sized microdispersion or hydrosol include the known polymers applicable for paper coating, preferably based on acrylic esters, such as ethyl

acrylate, butyl acrylate, 2-ethylhexyl acrylate; as well as polymers based on ethyl/vinyl-acetate copolymers, polyurethanes, copolymers of acrylate/vinyl-acetate, as well as copolymers based on styrene and acrylates.

The solids content of the coating agent according to the present invention is in the range of 20 to 50% solids or polymer content; however, depending on the application technological adjustment, the solids content may vary to a greater extent.

The polymers used according to the present invention are known commercial products.

The small-sized polymer's particle size is so small that the solution appears to be nearly transparent and that in case of light transmission it can hardly be visually detected; what is more, it has nearly the same refractive index as water. Such products may also be referred to as hydrosols. The small-sized polymers are not cross-linked because of their hydrosol properties..

The coating agent according to the present invention meets the highest requirements with respect to quality. Moreover, the coating agent according to the present invention stands out for extraordinary economic efficiency, because metering involving accurate adjustment of the layer thicknesses may be effected by using the engraved-rolls-method.

The papers coated with the coating agent according to the present invention stand out for high homogeneity of the applied layer as well as for an only small layer thickness.tolerance. This advantageous result is achieved by means of engraved rolls as well as by using the gravure coating method.

The present invention will be illustrated in more detail with reference to the following drawings.

Figure 1 shows the distribution of coarser polymer particles (5) and the finest particles of the hydrosol (6); it can be seen that the interspace between the relatively large polymer particles is filled up with the particles of the hydrosol (6) which are smaller by a factor of up to 50.

Figure 2 illustrates the penetration depth PE into the paper surface, the vector Ptg representing the particle size of the coating.

Figure 3 shows a section through a coated paper. The actual paper layer (3) formed by fibers is sealed to the top by the conventional paper coating (2) and to the bottom by the back finish (4). The upper top coat (1) does not comprise any fibers of the base paper (value 0), whereas some fibers project into the conventional paper coating (2) and more of them into the back finish (4).

The coating agent according to the present invention offers the further advantage that each polymer component can be varied for special objects. For example, the finest component may be designed soft and flexible so that it penetrates deeper into the paper coat (2), as is known from experience, (cf. diagram of Figure 2), whereas the coarser dispersion particles, which are designated to form a scratch-resistant surface, arrange closer to the surface.

In order to vary the surface properties to an even greater extent, a third component may be used, e.g., very fine-emulsified synthetic wax or polyethylene; for example, to obtain hydrophobic surfaces. The gas permeability may also be controlled. For example, the required high waterproofness may be obtained by a third component, e.g., prime coating with ethylene-acrylate copolymers to obtain a water vapor barrier. Also, the capability of being

composted may be influenced by suitable additives, such as nitrated water-soluble cellulose. It has been found that such an addition may increase the application possibilities of putrefactive bacteria, resulting in shorter composting periods of the paper thus coated.

The coating agent according to the present invention with two different polymer phases is suitable not only as a coating in preparation for metal deposition, in particular in vacuo, but, in addition to that, it may also be used as a primer layer which is applied after application of the metal layer, for example to render the paper printable. Good adhesion of the printing color, such that is does not come off, has up to now only been achieved with polymer coatings of organic solvents. In the past it was found that the use of aqueous polymer dispersions, e.g., in the cleaning of beer bottles which are washed with a 2% lye, resulted in detachment of the primer layer, i.e., the layer applied on the metal layer including the printing ink, and contamination of the cleaning bath.

It has been surprisingly found that when the coating agent according to the present invention is applied as primer or printing primer on the aluminized surface there is no solubilization of primer and/or printing color, thus avoiding any contamination of the washing lye with substances already present on the paper surface.

The following example will illustrate the present invention in more detail, parts meaning parts by weight.

70 parts of an aqueous acrylic ester dispersion having a particle size of 0.5 to 2 μm (type: Lefasol 206*, manufacturer: Lefatex-Chemie GmbH) are mixed under stirring with 30 parts of hydrosol having a particle size of 0.05 μ (type: Hydrosol 900*, manufacturer: Lefatex), resulting in a liquid emulsion paint having a polymer content of 37 (± 2%). This paint is applied on a label paper of

*Trade mark

70 g/m² by means of an engraved roll and then dried. A glossy, continuous film remains on the paper, which can excellently be metallized. After high-vacuum metal deposition using aluminum, the sensitive aluminum layer is protected with the primer which is applied by means of engraved rolls and then dried.

In addition, the primer serves as a primer for possible further treatments, e.g., prints.

Another advantage of the coating agent according to the present invention is the high solids content with usual service viscosities. The polymers of the art dissolved in the organic solvent have a viscosity of about 18 to 22 seconds in the DIN-beaker at a solids content of 20%. In the used engraved roll technology with the required viscosities, a solids content of 40% (polymer) may be achieved resulting in a considerable cost reduction.